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NEXT DAY...

WOW! THAT WAS AMAZING!

HUH? COOL IT, MOM, GIVE ME ONE MORE MINUTE.

RILEY! WAKE UP!

RILEY, WAKE UP! WE JUST WENT TO MARS! CAN YOU BELIEVE IT? THAT WAS AMAZING! MARS WAS SO RED, AND THE ROBOT TALKED TO US.

YAWN. SKIP IT, STELLA. IT WAS JUST A WEIRD DREAM.

OOGAHH, CHECK IT OUT. RILEY HAS A NEW GIRLFRIEND.

OOGAHH, CHECK IT OUT. RILEY HAS A NEW GIRLFRIEND.

PFFT. SHE WISHES.

RILEY, ARE YOU LISTENING?

YEAH, CUTE COUPLE, I’D SAY. HA HA HA.

RILEY, IT WASN’T A DREAM.

RILEY, DID YOU HEAR WHAT I SAID?

JUST LEAVE ME ALONE! FORGET IT.

OK, EVERYONE, LINE UP AND LET’S GET THIS BUS LOADED UP. ROLL CALL!

HERE...

RILEY, DID YOU HEAR WHAT I SAID?

OK, EVERYONE, LINE UP AND LET’S GET THIS BUS LOADED UP. ROLL CALL!

WHAT? IT’S MR. HALLEY?!
TWO WEEKS LATER

WHO CAN NAME ALL THE PLANETS VISIBLE WITH THE NAKED EYE?

VENUS! MERCURY! MARS! JUPITER? SATURN!

MRS. JAAK, WHY IS MARS CALLED THE "RED PLANET"?

THAT'S A VERY GOOD QUESTION, STELLA. THE SURFACE OF MARS HAS A LAYER OF RUSTY DUST THAT HAS A RED COLOR. THAT'S WHY MARS ALWAYS LOOKS RED.

MRS. JAAK! DOES LIFE EXIST ON TRAPPIST-1 PLANETS?

OR A SHINK, HAHAA!

STELLA, PLEASE STAY FOCUSED ON OUR LESSON TODAY.

NEXT TIME YOU VISIT THE GRIFFITH OBSERVATORY, THIS QUESTION IS PERFECT FOR DR. DAVE.

RILEY!

SPLAT
Okay, let’s settle down. Now look at the board.

Several rovers have been sent to Mars. Can anyone name one of those rovers?

Anyone, anyone at all?

I know! I know!

Ok, Riley.

Curiosity! And its job is to take pictures, dig around and send its findings to Earth.

Riley, enough jokes... wait, that’s correct!

Riley, you surprised me!

I accidentally studied this lesson, Mrs. Jaax.

That’s Mr. Halley! It wasn’t a dream.
OKAY, CLASS. PICK UP YOUR PHONES BEFORE YOU LEAVE!

WHERE DID HE GO? I SAW HIM.

COMING THROUGH.

HEY!

WHAT THE HECK? HUH?

IT WASN'T A DREAM. HE'S REAL. IT WASN'T A DREAM. I CAN PROVE IT.

SEE? IT'S MR. HALLEY!

HI, KIDS!

WHAT?

WHERE HAVE YOU BEEN? IT'S BEEN FOREVER!

IT WAS JUST TWO WEEKS. I'VE BEEN BUSY PLANNING YOUR NEXT TRIP. THE LAST ONE WAS JUST A TEST. YOU PASSED!

YOU TWO ARE THE TEAM I'VE BEEN LOOKING FOR. TOGETHER WE CAN DISCOVER THE SECRETS OF THE COSMOS.

YOU MEAN WE CAN GO ON ANOTHER ADVENTURE?

EXACTLY. COME BACK TO THE ZEISS TELESCOPE ON SATURDAY 1:00 PM. SHARP.

COME TOGETHER. I NEED YOU TWO TO BE A TEAM. YOU BOTH ARE SMART AND BRAVE IN A DIFFERENT WAY.

WE WILL BE THERE!

A TEAM?

GREAT!

WE NEED A TEAM NAME. THE DYNAMIC DUO?

THAT'S ALREADY TAKEN.

HOW ABOUT GALAXY SCOUTS?

JEEZ
YOU AND YOUR BIG IDEAS, I COULD HAVE BEEN PLAYING BASEBALL WITH THE GANG.

BUT YOU HEARD WHAT MR. HALLEY SAID!

YOU CAN PLAY BASKETBALL ANY TIME.

BASEBALL! UGH, GIRLS!! WHATEVER! YOU KNOW WHAT I MEAN!!

WE'RE HERE! ISN'T THIS EXCITING? I WILL PICK YOU UP AFTER THE TOUR!

YEAH, I'M GONNA FAINT FROM THE THRILL! OOF!

BYE, MOM!

OKAY, EVERYONE, FOLLOW ME, WELCOME TO THE GRIFFITH OBSERVATORY.

AT THE OBSERVATORY...

THE OBSERVATORY WAS BUILT IN 1935 BY GRIFFITH J. GRIFFITH, WHO WANTED EVERYONE TO BE ABLE TO SEE SPACE THROUGH A TELESCOPE. SO, HE CAME UP WITH THE IDEA OF A "PUBLIC OBSERVATORY".

SADLY NOT. THE CHRISTMAS STAR ISN'T REALLY A STAR. IT IS WHEN JUPITER AND SATURN ARE SO CLOSE TO EACH OTHER, THEY APPEAR AS A SUPER BRIGHT POINT OF LIGHT.

THIS SPECTACULAR EVENT IS VERY RARE. IT HAPPENED ON DEC. 21, 2020 FOR THE FIRST TIME SINCE THE MIDDLE AGES.

BUT WE CAN SEE THE "EVENING STAR" - WE USE THIS NAME FOR VENUS WHEN IT IS VISIBLE RIGHT AFTER SUNSET.
HERE IS OUR CHANCE. LET'S GO!

YEAH. YEAH.

THERE HE IS!

OVER HERE! TODAY IS THE BIG DAY.

HI, MR. HALLEY!

I HAVE A QUESTION FOR YOU. WHAT DO YOU THINK THE UNIVERSE IS MADE OF?

GOOD GUESSES.

BUT ACTUALLY SCIENTISTS BELIEVE THAT A LARGE FRACTION OF THE UNIVERSE IS MADE UP OF DARK MATTER.

DARK MATTER?

YOU REMEMBER FROM SCHOOL THAT THE FORCE OF GRAVITY KEEPS ALL OF THE PLANETS IN ORBIT AROUND THE SUN.

THE SAME FORCE KEEPS STARS IN ORBIT AROUND THE CENTER OF OUR MILKY WAY GALAXY. SO, NO STARS OR PLANETS FLOAT AWAY OR FLY OFF.

STARS ORBITING FAR AWAY FROM THE CENTER WILL EXPERIENCE A SMALLER GRAVITATIONAL FORCE AND SO WE WOULD EXPECT THEM TO SLOW DOWN.

BUT SCIENTISTS HAVE ACTUALLY OBSERVED THE OPPOSITE - FAR AWAY STARS ARE ACTUALLY MOVING AS FAST AS THE STARS CLOSE TO THE CENTER OF THE MILKY WAY. VERY MYSTERIOUS...
COOL. LIKE THE DARK SIDE OF THE FORCE.
DON’T BE ANNOYING, RILEY.
SAYS WHO?
DO YOU ALWAYS....
PLEASE DON’T ARGUE. YOU ARE A TEAM. TEAMS WORK TOGETHER.
OKAY.

POOF

AS I WAS SAYING, SCIENTISTS ARE TRYING VERY HARD TO FIGURE OUT WHAT DARK MATTER IS MADE OF. THEY CAN’T SEE SOMETHING THAT DOESN’T EMIT LIGHT. THAT’S WHERE YOU TWO COME IN.

I HAVE INVENTED THE TELESCOPIC TRANSPORTING TELESCOPE OR “TTT” AS I CALL IT.

TTT?

WITH THIS DEVICE I CAN STUDY THE UNIVERSE IN WAYS OTHER SCIENTISTS CAN’T. YOU KNOW SINCE YOU HAVE ALREADY TAKEN ONE RIDE ON IT.

I CAN’T WAIT TO GO AGAIN!
I've improved the communicators in your suits, and added a safety recall device.

Safety recall?

Yes, this device will teleport you back here in case of any emergency. How does it work?

You have to choose a safe word, say the word and the telescope will instantly transport you back here. How about "dark matter"?

That's boring. How about "Darth Vader"?

Okay, "Darth Vader" it is.

Darth what?

Darth Vader... Star Wars.

What's that? A movie?

You are truly hopeless.

I've also added X-ray scanners. When you press the button on the side of your helmet, you will have X-ray vision. Try it out and see what happens.

But wait! There is one more big surprise!

It's showtime!

What is it?
LET ME INTRODUCE YOU TO A GUEST MEMBER ON YOUR JOURNEY TODAY.

GUEST...

MEMBER?

COME ON IN, DANIEL.

MEET STELLA AND RILEY. THIS IS MY NEPHEW FROM ENGLAND, DANIEL!

DANIEL WAS BORN WITH CEREBRAL PALSY, BUT THAT DIDN’T STOP HIM FROM BECOMING ONE OF BRITAIN’S MOST PROMISING JUNIOR SCIENTISTS!

NICE TO MEET YOU. THANKS FOR LETTING ME JOIN YOU.

WELCOME TO THE TEAM! IT WILL BE AWESOME TO HAVE YOU ALONG.

YOUR CHAIR IS TOO COOL. DID YOU DESIGN IT?

GREAT TO MEET YOU.

MAYBE YOU CAN SHOW ME WHAT IT CAN DO LATER.

MOST OF IT, BUT I HAD A LOT OF HELP.

GREAT! WE’D BETTER GET READY. THE TOUR WILL BE FINISHED IN ONE AND A HALF HOUR. WE DON’T WANT YOU TO BE MISSED, DO WE?

LET’S GO!
ZZZZZZZZZZZZZZZZZZZ

WHAT A RUSH!

THAT WAS MOST EXHILARATING!

SOOOOOOOO BEAUTIFUL! YOU CAN SEE GALAXIES!

WOW!

WHERE ARE WE?
According to my star charts, we are somewhere in the bullet cluster.

Wow, your chair is like a transformer and a computer.

I'm going to try on my x-ray scanner.

Whoa!

It has mini jets for moving. See!

How fast can it go? Oh man, I want mini jets!

That's strange, we don't seem to be moving.

Wow!

Oh my! These glasses are fantastic. It looks as if the whole sky is on fire...

It's incredible. The gas in the nebula must be causing these amazing colors. Guys, are you seeing this?

Guys...Guys...Guys! I'm being pulled into that fire!
ARE YOU GUYS LISTENING? I’M BEING PULLED INTO THAT ENORMOUS FIRE!

WHAT FIRE?

WHAT ARE YOU TALKING ABOUT? STELLA, ARE YOU USING THE X-RAY SCANNER?

LOOK! WHAT IS THAT?

I SEE IT!

TURN ON YOUR X-RAY SCANNER!

SEE WHAT?! OH, SOMETHING IS HIDING IN THE NEBULA.
LOOK! A DRAGON! WE'RE GETTING PULLED INTO IT!

IT'S GONNA EAT US!

WHAT IS THE SAFE WORD? DARK MATTER? AHHH...WHAT'S THAT WORD?

WE'D BETTER GET OUT OF HERE!

DARTH VADER!!
Well, that was a fast trip. What happened? You've only been gone for 15 minutes!

I was being pulled towards a beautiful slow between galaxies, and then suddenly the colors got brighter and a humongous dragon began to come out of the swirling colors.

We found that even though we had my jets on, we weren't moving at all.

And it was getting hotter!

"Hotter"? I was being boiled alive, and I was about to be eaten by a cosmic dragon!

Hmm, it's just as I suspected. What all of you saw is the hot gas around galaxies that belongs to the cluster. It is very hot. About one hundred million degrees F.

"Hotter"? I was being boiled alive, and I was about to be eaten by a cosmic dragon!

So, what I saw was just hot gas?

Yes, the hot gas produces light that can only be seen with X-ray scanners.

What about the space dragon??

The cluster's gravitational field is so strong that it bends the light coming from the galaxy, making some galaxies look very stretched like a dragon. This just confirms that the bullet cluster is very massive!

Galaxy behind the cluster. Very massive objects like galaxy clusters behave like a giant magnifying glass and make galaxies look very large and stretched.
I was hoping the mass in the hot gas would be enough to explain the gravitational pull that galaxies in the cluster feel, but it only helps a little.

The journey into dark matter continues, my young scientists...

Way to go, guys...

Beep Beep Beep

Wait a moment. There's a message coming through on our emergency channel!

Oh my goodness!

What?

Beep Beep Beep

It's an SOS from Curiosity!

Unfortunately, our research into dark matter will have to wait for a future day.

Curiosity is in trouble and needs our help. I know you just got back, but are you willing to go out again?

Anything for our buddy Curiosity.

Let's do it!

Be careful! And here we gooooooooo!

Zzzzzzzzzzzzzzz

To be continued
Glossary

**Planets visible to the naked eye:** Five planets in the solar system are visible to the naked eye: Mercury, Venus, Mars, Jupiter, and Saturn.

**Mars “the red planet”:** The surface material (or regolith) of Mars contains a lot of iron oxide (FeO), and it is what gives Mars its red color. Earth also has a lot of FeO but most of it sunk to the core of the planet; while Mars, due to its smaller size and weaker gravity, has much more FeO on its surface.

**Trappist-1 planets:** Trappist-1 is a star in the Milky Way with a planetary system consisting of seven planets. Four of the seven planets are located in the star's habitable zone and are potentially hospitable for life.

**Griffith Observatory:** An observatory in Los Angeles, USA. It is named after its benefactor, Griffith J. Griffith. The observatory was opened in 1935. Griffith's objective was to make astronomy accessible to the public, as opposed to the dominant idea that observatories should be located on remote mountaintops and restricted to scientists.

**Zeiss telescope:** The 12-inch (30.5 cm) optical refracting telescope at the Griffith Observatory. Refracting telescopes use lenses to focus the light and form images of astronomical sources.

**Mars rovers:** Motor vehicles designed to travel on the surface of Mars, collecting information and exploring the planet. As of 2022, there have been six Mars rovers: Sojourner (1997), Spirit (2004–2010), Opportunity (2004–2018), Curiosity (2012–), Perseverance (2021–), and Zhurong (2021–).

**Christmas star:** Refers to Jupiter and Saturn when they cross paths so close to each other that they are barely distinguishable from one another to the naked eye. One such event happened on December 21st, 2020 when Jupiter and Saturn were so close in the sky that they appeared as one bright shining star in the sky, which we call the Christmas star. We will have to wait until the year 2080 for this to happen again.

**Evening star:** As the planet Venus always appears close to the Sun in the sky, it is visible usually soon after sunset in the evening or in the morning just before sunrise. This is why Venus is frequently called the Evening or Morning star.

**Dark matter:** An invisible, mysterious type of matter in the universe that scientists have not been able to detect directly, using existing telescopes. It is called “dark” because it does not interact with light and is therefore impossible to detect directly. However, we can sense its presence through the gravitational force it exerts. For example, due to the presence of dark force, galaxies revolve or orbit around their centers much faster than would be expected, if we account for all the matter that can be directly measured (e.g. stars, gas). The presence of dark matter explains why galaxies orbit so fast.
**Glossary**

**X-ray:** A type of light. There are several types of light, all each having different wavelengths of radiation. X-ray light has a smaller wavelength and carries more energy than the visual light that we can see (colors of the rainbow). Many astronomical sources, such as disks around black holes, neutron stars, binary star systems, supernova remnants, and stars, give off X-ray light.

**Bullet Cluster of galaxies:** Galaxies exist in a group or cluster of other galaxies. The Bullet Cluster of galaxies is one of those large groups. It consists of two colliding smaller clusters of galaxies. It is especially well known for providing important evidence of the existence of dark matter.

**Intercluster gas:** The matter that exists in between galaxies in galaxy clusters. This medium mainly consists of very hot gas that has a temperature of millions of degrees. Intercluster gas can be studied using X-ray telescopes.

**Gravitational lensing:** The effect that gravity has on the light that travels from distant sources and passes by a massive object. The strong gravitational force of the massive object bends the light, causing multiple images of the distant sources.
Stella, Riley and Daniel are rushing to Curiosity’s rescue. What will happen when they get to Mars? What happened to Curiosity? Follow their adventures in Book 3! Coming soon!